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COSTS OF FARM MACHINERY IN CROP PRODUCTION

in Northwestern Ohio, By Size of Farm

Farm Production Economics Division
Economic Research Service
U. S. DEPARTMENT OF AGRICULTURE

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Washington, D.C. August 1964

SUMMARY

Cost per unit of owning and operating tractor-drawn and tractor-mounted equipment on northwestern Ohio farms varies with size of farm. Large farms have lower costs per implement and per acre of use than medium-sized farms, which in turn have lower costs than small farms. These conclusions are based on a study of machinery costs in 1960 on small, medium-sized, and large farms having total acreages ranging from 60 to 100 acres, 140 to 180 acres, and 280 to 360 acres, respectively.

The farms studied were limited to full-time farms on which crop sales provided the major source of gross farm income. Corn, soybeans, and small grains were the major crops, occupying from 85 to 90 percent of the cropland. The proportion of farms growing hay increased as size of farm increased. More than 90 percent of the small farms were owner-operated, whereas part or all of the land was rented on 80 percent of the large farms.

Total machinery costs per acre of use include fixed and variable costs of implement and tractor and a charge for the tractor driver's labor. These costs on the large farms averaged only two-thirds as high as on the small farms and about four-fifths as high as on the medium-sized farms. Lower costs per acre on large farms resulted chiefly from the larger acreage covered per machine annually, and use of newer, more efficient, and larger machines. The combination of these factors significantly reduced charges for depreciation, interest, operator labor, and fuel per acre of use.

Tractor cost per hour of operation was slightly lower on the medium-sized farms than on either the small or large farms. The smaller and older tractors on the small farms used fuel less efficiently and had higher repair costs than the tractors on the other farms. The large farms with newer and larger tractors had higher fixed charges for depreciation and interest.

Tractor cost per acre was 31 percent lower on the large farms than on the small farms and 17 percent lower than on the medium-sized farms. On the small and large farms, tractor cost per acre was about the same as cost of tractor drivers; on the medium-sized farms it was slightly lower.

Costs per acre for the 13 major kinds of implements used on these farms were 37 percent lower on the large farms than on the small farms and 27 percent lower than on the medium-sized farms. A large part of the difference in cost resulted from greater annual use and the resulting lower fixed charges per unit of use on the larger farms. But equally important was the lower repair cost and greater capacity of the newer machines on the larger farms.

On farms of all three sizes, costs of tractor, tractor driver, and major farm implements each accounted for about one-third of the total cost of using machinery.

Original investment in farm machinery ranged from nearly $6,000 per farm on the small farms to $8,800 on the medium-sized farms and $14,400 on the large farms. Operators of small farms bought a higher proportion of used equipment. The machines were smaller and generally older than on the other farms, indicating that they were bought at lower price levels. Investment per acre averaged $77 on small farms, $62 on medium-sized farms, and $53 on large farms.

COSTS OF FARM MACHINERY IN CROP PRODUCTION IN NORTHWESTERN OHIO, BY SIZE OF FARM

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One of the largest items of expense in crop production is the cost of owning and operating farm machinery. Undoubtedly, machinery cost varies widely from one farm to another. Cost per acre, per hour, and per unit of production also varies widely among farms. This variation is in part a result of differences in size of farms and consequently in the volume of production over which fixed costs can be spread. Also, part of the variation is due to the success with which individual farmers adapt their use of machinery to the particular needs of their farms.

The purpose of the study reported here was to estimate the cost, including labor cost, of owning and operating tractors and the 13 major farm implements used on farms in northwestern Ohio, and to show how this cost was affected by the size of farms. The report presents estimates of cost per unit of use on three sizes of farms.

This is one of a group of studies by the Economic Research Service on cost of production by size of farm in several major type-of-farming areas. [1]

METHOD OF STUDY

Data for the study were obtained by personal interviews in June 1961 with operators of a randomly selected sample of 182 farms in eight counties in northwestern Ohio. Three criteria were applied to each farm in the area before final selection of sample farms: (1) An estimated 50 percent or more of the gross farm income was from the sale of crops; (2) the operator worked off the farm less than 30 days during the 1960 crop season; and (3) the farm contained about 60 to 100 acres, 140 to 180 acres, or 280 to 360 acres of land.

Each farmer interviewed was asked to furnish complete information on costs and use of each unit of equipment owned and used on his farm or other farms for custom or exchange work in 1960. The information included, for each machine, the year of purchase, age when bought, purchase price, and value on December 31, 1960. Information was obtained for the year 1960 on expenditures for repairs; farm labor used for repairs and service; fuel, lubricants, and antifreeze used; and total use of the machine during the year and average use per day.

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[1] For reports on completed studies see (3), (4), (5), (6), and (7), Bibliography, p. 19.

Prices of fuel, lubricants, and antifreeze were taken from published reports of the U. S. Department of Agriculture.

Most of the data in this report are limited to the tractors and the 13 major kinds of implements used in producing corn, soybeans, small grains, and hay on the survey farms. Farmers reported owning and using other machines and equipment, including hay balers, subsoilers, lime spreaders, sprayers, self-propelled combines, hay crushers, and manure spreaders. Estimates of investment in these other machines are presented also. However, the costs of owning and using them were not estimated, either because the number reported, especially on the small farms, was insufficient for reliable analysis, because information was incomplete on some items of cost, or because the use of the machines was not closely related to the acreage of cropland.

DEFINITIONS

Small, medium-sized, and large farms.--The farms were divided into three groups based on total acreage, which included owned and rented land but excluded land rented out or in the Conservation Reserve (table 1). These farms are representative of the farms of 80, 160, and 320 acres that are common in the area.

Main and auxiliary tractors.--For descriptive purposes, tractors were divided into two groups, principally according to use. Main tractors were those used mostly for heavy-drawbar work. Each farm had one main tractor. Auxiliary tractors were those used less frequently as when an extra tractor was required, or for light-drawbar and stationary work.

Major farm implements (13 farm implements).--The major kinds of implements on the study farms were the moldboard plow, tandem disk, spiketooth harrow, springtooth harrow, cultipacker, rotary hoe, corn planter, row cultivator, cornpicker, grain drill, combine with power takeoff, mower, and side-delivery rake.

Number of tractors or designated implements per farm.--This is the average number per farm in the size group, including farms that did not report having the particular implement.

Average size, age, and value.--These are expressed as the arithmetic mean of the observations. Because of diversity of sizes of a given kind of implement, the mean may not equal a common size. For example, in one group of farms the average size of plow is approximately 35 inches, which is about midway between a 2-bottom 14-inch and a 3-bottom 14-inch plow. Age and value are as of December 31, 1960.

Farm labor for repair and service.--This is work done by the operator, members of his family, or regular hired farmworkers for (1) major repairs, maintenance, and seasonal preparation of machinery, and (2) periodic servicing including minor adjustments and repairs. Periodic servicing was reported in minutes per 10-hour day. These estimates were multiplied by the number of 10-hour days each machine was used during the year and added to the total time reported for major repairs.

Annual use.--Annual use of tractors is measured in hours; annual use of implements is measured in acres covered. Use of tractors in 1960 represents the average number of hours tractors of all sizes were operated for all purposes. Use of a given implement represents the arithmetic mean of total acres, on a once-over basis, on which the machine was used. Annual use includes custom work and exchange work, if any.

Table 1.--Number of farms, total land per farm, and cropland per farm; small, medium-sized, and large survey farms, northwestern Ohio, 1960

Size group	Farms in group	Total land per farm		Cropland per farm	
		Range	Average	Range	Average
	Number	Acres	Acres	Acres	Acres
Small farms	53	57-105	87	47-103	77
Medium-sized farms	63	135-224	162	75-209	141
Large farms	66	274-384	311	155-356	272

PROCEDURE

The assumptions and methods used in computing costs can materially affect the estimates of machinery costs. This is true especially of such items as depreciation, interest on investment, and charges for farm labor used for repair, service, and operation. The methods by which these and other costs were computed for this study are described below.

Calculation of Fixed Costs

Depreciation.--The cost of depreciation on a tractor or implement for the year 1960 is the arithmetic mean of the difference between the present owner's purchase price of the machine and its value December 31, 1960, divided by the number of years from the time of purchase through 1960.

Interest on investment.--This charge was assumed to be 5 percent of the value of the machine on December 31, 1960.

Personal property tax.--Personal property tax was estimated at 1 percent of the value of the machine on December 31, 1960. This approximates the current average tax rate on farm machinery in Ohio. Rates within the counties surveyed may differ from these rates. However, since this analysis deals chiefly with comparisons among sizes of farms, any deviation between actual and assumed rates is believed to have no significant effect on the results.

Loss and damage.--The estimated annual cost of loss or damage to machinery resulting from fire, lightning, windstorm, upset, and theft was assumed to be 25 cents per $100 of value as of December 31, 1960.

Calculation of Variable Costs

Repair.--This is the cash cost in 1960 of replacement parts and mechanics' labor. The average cost of repairs to each kind of machine was calculated by dividing the total amount of repairs reported by farmers in the size group by the total number of such machines, including those having no repair cost in 1960.

Farm labor for repair and service.--Cost of this labor was assumed to be $1.08 per hour. This was the wage paid hired farmworkers in the area, without room and board, in 1960. The average cost of this service for each machine was estimated by dividing the total charged to each kind of machine by the number of machines in the group.

Tractor drivers.--In arriving at cost of tractor operation, labor for driving the tractor was assumed to cost $1.08 an hour, the rate used in estimating farm labor for repairs and service.

Fuel and lubricants.--Farmers reported the quantity of lubricants and of each kind of fuel used by each tractor in a 10-hour day. For farms in each size group, the estimate was based on the average quantity consumed per day by tractors of each size represented on the farms, weighted by the number of tractors of that size. The quantity of lubricants was estimated in the same way. Prices used in estimating cost of fuel and lubricants were 17.5 cents a gallon for gasoline, 15 cents a gallon for diesel fuel, 15 cents a gallon for tractor fuel, 31.7 cents a quart for motor oil, and 23 cents a pound for grease.

Cost of lubricants used for machinery other than tractors was assumed to be included in the cost of lubricants used in tractors.

Calculation of Total Cost of Operation

Cost per hour of tractor operation.--This cost was estimated for farms in each size group by (1) dividing the total annual fixed and variable costs per tractor by average hours of tractor use in 1960, and (2) adding $1.08 for the driver.

This method of estimating tractor cost indicates cost relationships among farms of different sizes, rather than the exact cost of operation of a tractor with a particular implement. For example, the actual cost of a tractor operated with a moldboard plow probably was higher than the cost of using the same tractor to pull a harrow, but ignoring this difference did not change the relationship of costs among different sizes of cash crop farms.

Implement cost per acre of use.--For farms of each size group, this cost was estimated by dividing the average annual cost for an implement by the average acres of use in 1960. The associated cost per acre for tractor and driver was computed by multiplying the cost per hour for tractor and driver by the operating time per acre. It was assumed that only one implement was used at a time. Some farmers in the survey, however, reported using machines in tandem for such operations as disking and cultipacking. This practice was most common on the larger farms. The number of farms in each size group using specified combinations is given in appendix table 17.

DESCRIPTION OF FARMS AND MACHINES

Farms

In 1960, the major crops on the survey farms were corn, soybeans, and small grains. These three crops were grown on nearly all of the farms, and occupied from 85 to 90 percent of the total cropland (table 2). The proportion of farms using cropland for hay, silage, or pasture rose as the size of farms increased.

Table 2.--Organization and utilization of cropland on small, medium-sized, and large survey farms, northwestern Ohio, 1960

Item	Size of farm		
	Small	Medium-sized	Large
	Number	Number	Number
Farms in sample	53	63	66
	Acres	Acres	Acres
Cropland per farm	77	141	272
	Percent	Percent	Percent
Percentage of farms using cropland for--			
Corn for grain	96.2	95.2	98.5
Soybeans for beans	94.3	95.2	100.0
Small grains	98.1	100.0	100.0
Legumes and grasses for seed	17.0	12.7	13.6
Hay, silage, and pasture	54.7	74.7	81.8
Other purposes 1/	5.7	9.5	6.1
Farms with livestock	83.0	85.7	84.8
Percentage of cropland used for--			
Corn for grain	36.3	31.3	34.0
Soybeans for beans	25.9	24.2	26.4
Small grains	25.8	27.1	26.7
Legumes and grasses for seed	2.0	1.3	1.1
Hay, silage, and pasture	9.0	14.1	11.4
Other purposes 1/	1.0	2.0	.4
Total	100.0	100.0	100.0

1/ Cover crop plowed under, sugarbeets, tomatoes, potatoes, popcorn, and idle.

The proportion of farms with livestock was about the same--between 83 and 86 percent--in all three size groups.

Nearly all of the small farms were wholly owned by the operators (table 3). Less than a fifth of the large farms were wholly owned by the operators; nearly two-thirds of these farms were operated by owners who rented additional land. Renting additional land, as opposed to buying it, was the most common method of enlarging farms. More than 80 percent of the farmers on large farms rented land, compared with 44 percent on the medium-sized farms and about 8 percent on the small farms.

Table 3.--Tenure status of operators of small, medium-sized, and large survey farms, northwestern Ohio, 1960

Tenure status	Small farms	Medium-sized farms	Large farms
	Percent	Percent	Percent
Owner	92.4	55.6	19.7
Owner-renter 1/	0	23.8	30.3
Renter-owner 2/	3.8	11.1	33.3
Renter	3.8	9.5	16.7
Total	100.0	100.0	100.0

1/ Acreage of rented land does not exceed acreage of owned land.
2/ Acreage of rented land exceeds acreage of owned land.

Farm Machinery

Tractors

All of the farms had at least one tractor and most of them had two (table 4). About half the large farms had three. With the exception of one tracklayer, all tractors were row type.

The tractor on each farm that was used the most is referred to in this report as the main tractor; the others are called auxiliary tractors. Usually the main tractors were newer and larger than the others. On the large and medium-sized farms, most of the main tractors were new when the present owners bought them, whereas only about half the auxiliary tractors were bought as new machines. On the smaller farms, however, most of both the main and auxiliary tractors were used machines when bought by the present owners.

Gasoline was used for fuel in nearly all the tractors except the main tractors on the large farms; nearly a fifth of these burned diesel fuel. The annual use of tractors ranged from an average of 594 hours per year for main tractors on large farms to 216 hours for auxiliary tractors on small farms. The potential use of these tractors is much higher than the actual use, and cost per hour could be much lower with greater use. However, farmers apparently consider the convenience of extra tractor power when needed to be more important than lower cost per hour of use.

Size of Implements

The variety in size of implements shown in table 5 indicates that farmers in the sample had attained considerable success in obtaining machines in sizes appropriate for their farms.

On the small and medium-sized farms, less than half the moldboard plows were larger than 2 bottoms. On the large farms, 83 percent of them were 3 bottoms or larger. Fifty-six percent of the tandem disks on the small farms were 7 feet wide or less; on the large farms 86 percent were 8 feet wide or larger. A similar difference between large and small farms existed for all other major implements except side-delivery rakes, whose size appeared to be unrelated to size of farm. All sizes of farms did about equally well in matching size of implements to size of tractors (table 6).

Table 4.--Main and auxiliary tractors: Number, size, and related data; small, medium-sized, and large survey farms, northwestern Ohio, 1960 1/

Item	Unit	Small farms			Medium-sized farms			Large farms		
		Main tractors	Auxiliary tractors	All tractors	Main tractors	Auxiliary tractors	All tractors	Main tractors	Auxiliary tractors	All tractors
Farms using	Number	53	41	53	63	55	63	66	66	66
Tractors on farms	do.	53	43	96	63	66	129	66	100	166
Tractors per farm	do.	1.00	.81	1.81	1.00	1.05	2.05	1.00	1.52	2.52
Average per tractor: -										
Size (rated drawbar)	Hp.	24.04	17.71	21.21	26.68	19.15	22.83	31.15	22.00	25.64
Age Dec. 31	Year	10.34	13.65	11.82	7.92	13.38	10.71	6.00	10.80	8.89
Original investment	Dollar	1,498	1,017	1,282	1,963	1,161	1,553	2,734	1,546	2,019
Value Dec. 31	do.	668	367	533	1,193	461	819	1,693	785	1,146
Use during year	Hour	326	216	277	538	336	434	594	406	481
Percentage of tractors using--										
Gasoline	Percent	97.0	97.3	97.1	93.2	90.4	92.3	82.2	95.4	87.8
Diesel fuel	do.	---	---	---	3.6	---	2.4	17.8	4.6	12.2
Other fuel	do.	3.0	2.7	2.9	3.2	9.6	5.3	---	---	---
Total	do.	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Age of tractor when purchased:										
New	do.	41.5	25.6	34.4	57.1	45.5	51.1	75.8	49.0	59.7
1 to 5 years	do.	37.7	37.2	37.5	38.1	30.3	34.1	22.7	22.0	22.3
6 to 10 years	do.	13.2	20.9	16.7	1.6	10.6	6.2	1.5	16.0	10.2
11 years or more	do.	7.6	16.3	11.4	3.2	13.6	8.6	---	13.0	7.8
Total	do.	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

1/ Includes 1 tracklayer.

Table 5.--Major farm implements: Percentage distribution by size; small, medium-sized, and large survey farms, northwestern Ohio, 1960

Kind and size of implement	Small farms	Medium-sized farms	Large farms
	Percent	Percent	Percent
Percentage of moldboard plows that were--			
2-bottom, with--			
12-inch share	19	8	3
14-inch share	34	42	14
16-inch share	0	0	0
3-bottom, with--			
12-inch share	13	4	6
14-inch share	34	42	58
16-inch share	0	1	1
18-inch share	0	0	1
4-bottom, with--			
12-inch share	0	0	1
14-inch share	0	3	14
16-inch share	0	0	0
18-inch share	0	0	1
5-bottom, with--			
12-inch share	0	0	0
14-inch share	0	0	1
16-inch share	0	0	0
Total	100	100	100
Percentage of tandem disks that were--			
7 feet or less	56	50	14
8 and 9 feet	35	30	36
10 feet or more	9	20	50
Percentage of spiketooth harrows that were:			
8 feet or less	50	27	9
9 to 11 feet	42	62	51
12 feet or more	8	11	40
Percentage of springtooth harrows that were:			
8 feet or less	45	38	13
9 to 11 feet	55	53	61
12 feet or more	0	9	26
Percentage of cultipackers that were--			
8 feet or less	62	38	8
9 to 10 feet	38	51	59
11 feet or more	0	11	33
Percentage of rotary hoes that were--			
2-row	55	50	13
3-row	0	5	7
4-row	45	45	76
6-row	0	0	4
Percentage of cornplanters that were--			
2-row	86	61	8
4-row	14	39	92
Percentage of row cultivators that were--			
2-row	87	77	32
4-row	13	23	68
Percentage of cornpickers that were--			
1-row	86	55	22
2-row	14	45	78
Percentage of grain drills that were--			
12 openers or less	67	38	16
13 to 15 openers	31	52	51
16 openers or more	2	10	33
Percentage of combines with power takeoff that were--			
5 and 5 1/2 feet	46	38	22
6 feet	49	37	30
7 feet	5	23	44
8 and 9 feet	0	2	4
Percentage of mowers that were--			
5 and 6 feet	44	20	12
7 feet	56	80	88
Percentage of side-delivery rakes that were--			
7 feet or less	28	45	46
8 and 9 feet	33	26	29
10 feet or more	39	29	25

Table 6.--Rated drawbar horsepower of tractors per foot of width of implements, small, medium-sized, and large survey farms, northwestern Ohio, 1960

Implement	Small farms	Medium-sized farms	Large farms
Moldboard plow	7.9	7.9	7.3
Tandem disk	2.8	2.8	2.8
Spiketooth harrow	2.3	2.4	2.2
Springtooth harrow	2.5	2.4	2.5
Cultipacker	2.5	2.5	2.5
Rotary hoe	2.2	2.2	1.9
Row cultivator	2.6	2.6	2.2
Grain drill	3.1	3.0	3.1

Purchase of New and Used Implements

One of the methods by which operators of smaller farms hold down machinery investment is to buy used equipment. For example, only 37 percent of the major implements on the small survey farms had been bought new, compared with 67 percent on the large farms and 55 percent on the medium-sized farms (table 7). Of the machines bought second-hand, about three-fourths were less than 5 years old. There was little difference among farms of different sizes in this respect.

Table 7.--Major farm implements: Percentage distribution by age at time of purchase; small, medium-sized, and large survey farms, northwestern Ohio, 1960

Kind of implement and age at time of purchase	Small farms	Medium-sized farms	Large farms
	Percent	Percent	Percent
Percentage of moldboard plows that were--			
New	32	58	80
1 to 5 years old	46	35	14
6 to 10 years old	10	6	4
11 years old or more	12	1	2
Total	100	100	100
Percentage of tandem disks that were--			
New	44	62	73
1 to 5 years old	42	31	24
6 to 10 years old	10	7	2
11 years old or more	4	0	1
Percentage of spiketooth harrows that were--			
New	68	68	84
1 to 5 years old	24	23	12
6 to 10 years old	3	4	4
11 years old or more	5	5	0
Percentage of springtooth harrows that were--			
New	24	63	66
1 to 5 years old	59	31	29
6 to 10 years old	7	3	3
11 years old or more	10	3	2
Percentage of cultipackers that were--			
New	31	49	73
1 to 5 years old	51	32	25
6 to 10 years old	13	13	2
11 years old or more	5	6	0

Table 7.--Major farm implements: Percentage distribution by age at time of purchase; small, medium-sized, and large survey farms, northwestern Ohio, 1960--Continued

Kind of implement and age at time of purchase	Small farms	Medium-sized farms	Large farms
	Percent	Percent	Percent
Percentage of rotary hoes that were--			
New	43	42	71
1 to 5 years old	32	47	25
6 to 10 years old	21	7	4
11 years old or more	4	4	0
Percentage of cornplanters that were--			
New	23	56	67
1 to 5 years old	53	25	30
6 to 10 years old	12	14	3
11 years old or more	12	5	0
Percentage of row cultivators that were--			
New	37	54	53
1 to 5 years old	46	33	30
6 to 10 years old	8	9	13
11 years old or more	9	4	4
Percentage of cornpickers that were--			
New	31	53	66
1 to 5 years old	61	38	29
6 to 10 years old	8	5	5
11 years old or more	0	4	0
Percentage of grain drills that were--			
New	41	53	59
1 to 5 years old	43	37	35
6 to 10 years old	8	7	3
11 years old or more	8	3	3
Percentage of combines with power takeoff that were--			
New	28	44	54
1 to 5 years old	55	46	44
6 to 10 years old	7	4	2
11 years old or more	10	6	0
Percentage of mowers that were--			
New	37	60	71
1 to 5 years old	47	31	23
6 to 10 years old	5	5	4
11 years old or more	11	4	2
Percentage of side-delivery rakes that were			
New	50	60	65
1 to 5 years old	32	30	23
6 to 10 years old	11	4	12
11 years old or more	7	6	0
Average 13 implements that were--			
New	37	55	67
1 to 5 years old	45	34	25
6 to 10 years old	10	7	6
11 years old or more	8	4	2

ANNUAL USE OF TRACTORS AND IMPLEMENTS

For both tractors and implements, annual use per machine was highest on the large farms and next highest on the middle-sized farms (table 8). The differences, however, were less than proportional to size of farm because the larger farms had more machines, and also had more tractors relative to the acreage of cropland and number of implements.

Table 8.--Acreage of cropland and annual use of tractors and major farm implements; large and medium-sized survey farms as percentage of small farms, northwestern Ohio, 1960

Item	Small farms	Medium-sized farms	Large farms
	Percent	Percent	Percent
Cropland per farm	100	183	353
Annual use per tractor	100	157	174
Annual use per implement	100	168	287

The acreage covered per 10-hour day with each kind of implement rose with the size of farm. Larger implements and more powerful and faster tractors on the larger farms contributed to the difference. The field capacity of machines on the large farms averaged more than 40 percent greater than on the small farms (table 9). The width of machines on the large farms averaged about a fourth greater than on the small farms, and the acreage covered in a 10-hour day per foot of width, which is directly related to speed of travel and size and shape of fields, averaged 13 percent greater.

Table 9.--Size and capacity of major farm implements; large and medium-sized survey farms as percentage of small farms, northwestern Ohio, 1960

Item	Small farms	Medium-sized farms	Large farms
	Percent	Percent	Percent
Size of implements 1/	100	107	126
Acreage covered in 10-hour day 1/:			
Per implement	100	112	142
Per foot of width of implements	100	103	113

1/ See appendix table 18 for basic data.

OPERATING COSTS OF TRACTORS AND IMPLEMENTS PER UNIT OF USE

The cost per hour of using tractors is the average cost for tractors of all ages and sizes on each group of farms. The estimated cost of tractor use associated with each implement is based on this average. It is not the cost of operating the tractors actually used with each kind of machine. The time required per acre, however, is the actual time reported by farmers for the particular operation with the tractor used. The cost per acre thus accurately reflects differences among size-of-farm groups, but does not precisely measure the differences among operations.

Tractor Cost Per Hour of Use

Annual cost of owning and operating tractors was highest on the large farms. Because tractors on these farms were newer and larger than those on other farms, fixed costs--interest, taxes, and depreciation--were higher. Also, the tractors on large farms were used more hours per year, and, being larger, consumed more fuel per hour of use. Consequently, variable costs per tractor also were highest on large farms. Total annual cost per tractor was $513 on the large farms compared with $405 on the medium-sized farms and $304 on the small farms (table 10). Fixed costs accounted for just a little over half the total cost of tractors on the large farms and just under half the total on the medium-sized and small farms.

Table 10.--Tractors: Cost of operation, small, medium-sized, and large survey farms, northwestern Ohio, 1960

Item	Unit	Small farms	Medium-sized farms	Large farms
Farms using tractors	Number	53	63	66
Tractors on farms	do.	96	129	166
Tractors per farm	do.	1.81	2.05	2.52
Average per tractor:				
Size (rated drawbar)	Horsepower	21.21	22.83	25.64
Age Dec. 31	Year	11.8	10.7	8.9
Original investment	Dollar	1,282	1,553	2,019
Value Dec. 31	do.	533	819	1,146
Farm labor for repair and service	Hour	15.0	19.6	19.3
Use during year	do.	277	434	481
Cost per tractor:				
Depreciation	Dollar	114.00	134.00	192.00
Interest (5 percent) 1/	do.	26.65	40.95	57.30
Personal property tax (1 percent) 1/	do.	5.33	8.19	11.46
Loss and damage (0.25 percent) 1/	do.	1.33	2.05	2.86
Total fixed costs	do.	147.31	185.19	263.62
Repairs	do.	43.00	45.00	51.00
Farm labor for repairs and service 2/	do.	16.20	21.17	20.84
Fuel 3/	do.	85.43	137.55	159.84
Lubricants 3/	do.	8.61	13.55	14.74
Anti-freeze 3/	do.	2.97	3.03	3.26
Total variable costs	do.	156.21	220.30	249.68
Total costs	do.	303.52	405.49	513.30
Cost per hour:				
Tractor:				
Fixed costs	do.	.53	.43	.55
Variable costs	do.	.56	.51	.52
Total	do.	1.09	.94	1.07
Driver 2/	do.	1.08	1.08	1.08
Total cost	do.	2.17	2.02	2.15

1/ Dec. 31 value.

2/ Assumed rate of $1.08 per hour.

3/ See appendix tables 19-21.

Greater annual use per tractor on the large farms tended to reduce cost per hour; thus, this cost was about the same on the large as on the small farms, despite the difference in average size of tractors (table 11). The medium-sized farms had the lowest cost per hour of use. Total cost for tractor and operator was $2.17 an hour on the small farms, $2.02 on the medium-sized farms, and $2.15 on the large farms.

Table 11.--Tractors: Cost per hour of owning and operating on large and medium-sized survey farms, as percentage of cost on small farms, northwestern Ohio, 1960

Costs	Small farms	Medium-sized farms	Large farms
	Percent	Percent	Percent
Cost excluding operator:			
Fixed	100	81	104
Variable	100	91	93
Total	100	86	98
Total cost including charge for operator	100	93	99

Variable costs per hour were lower on the large and medium-sized farms despite the larger size of tractors on these farms. Some of the larger tractors used diesel fuel, thus reducing fuel costs, but variable costs of operating the larger tractors were lower chiefly because of relatively lower repair cost. The newer tractors on the larger farms may be partly responsible for lower repairs. Also, repair costs vary with use, but not proportionally, and therefore tend to be lower per hour of use with the greater annual use on the larger farms.

Cost Per Acre of Use for Major Implements

Implements on the large farms were generally larger and newer than those on the medium-sized and small farms. The size difference might have been greater except that many implements on smaller farms had been bought as used machines traded in by operators of larger farms. Although a used machine might be as large as its newer counterpart on a large farm in terms of width covered in one trip across the field, its field capacity was likely to be lower. The used machines lacked the hydraulic controls and other features which permit easier and quicker handling of the newer machines, and they were used with older and slower tractors.

Because implements on the large farms were on the average larger and newer, and had more convenience features, fixed costs per implement were highest on these farms. Fixed costs per acre were lower, however, because of the greater acreage covered by these implements (table 12). For the 13 major kinds of implements, fixed costs per acre on the medium-sized farms averaged 23 percent lower than on the small farms; on the larger farms they were a third lower (table 13).

Variable costs of using implements consisted largely of repair costs and charges for farm labor used in making repairs. However, the cost of repairs varied little, if any, with amount of use.

original investment; small, large, and medium-sized survey farms, Northwestern Ohio, 1960

Fixed costs 1/					Variable costs			Cost per acre				
Depreciation	Interest (5 percent)	Personal property tax (1.01 percent)	Loss and damage (0.25 percent)	Total	Repairs	Farm labor for repairs and service	Total	Fixed	Variable	Tractor and Driver	Total operation	
Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	
15.00	4.15	0.83	0.21	20.19	10.49	3.02	13.51	0.39	0.26	1.97	2.62	1
25.00	6.75	1.35	.34	33.44	13.41	5.83	19.24	.42	.24	1.70	2.36	2
38.00	9.40	1.88	.47	49.75	18.55	5.29	23.84	.36	.17	1.38	1.91	3
19.00	4.70	.94	.24	24.88	2.00	2.16	4.16	.18	.03	.87	1.08	4
26.00	6.10	1.22	.30	33.62	3.36	3.02	6.38	.16	.03	.79	.98	5
38.00	9.30	1.86	.46	49.62	6.49	4.24	10.73	.16	.03	.64	.83	6
8.00	1.95	.39	.10	10.44	1.18	.54	1.72	.11	.02	.82	.95	7
8.00	2.10	.42	.10	10.62	.25	1.02	1.27	.08	.01	.71	.80	8
12.00	2.70	.54	.14	15.38	.97	.56	1.53	.06	.01	.62	.69	9
12.00	2.80	.56	.14	15.50	1.03	.72	1.75	.18	.02	.82	1.02	10
16.00	4.00	.80	.20	21.00	1.20	1.07	2.27	.12	.01	.67	.80	11
16.00	4.55	.91	.23	21.69	3.46	1.44	4.90	.09	.02	.60	.71	12
8.00	2.50	.50	.13	11.13	2.05	.93	2.98	.13	.03	.85	1.01	13
10.00	3.50	.70	.18	14.38	.54	.81	1.35	.09	.01	.77	.87	14
18.00	4.75	.95	.24	23.94	.92	1.18	2.10	.09	.01	.64	.74	15
10.00	3.00	.60	.15	13.75	.70	.97	1.67	.23	.03	.50	.76	16
16.00	4.45	.89	.22	21.56	.62	.86	1.48	.23	.02	.36	.61	17
27.00	6.55	1.31	.33	35.19	1.25	1.54	2.79	.20	.02	.30	.52	18
20.00	5.15	1.03	.26	26.44	6.00	3.73	9.73	.57	.21	1.24	2.02	19
27.00	7.15	1.43	.36	35.94	9.02	4.67	13.69	.43	.16	.85	1.44	20
51.00	15.95	3.19	.80	70.94	11.48	6.25	17.73	.43	.11	.62	1.16	21
14.00	4.05	.81	.20	19.06	9.74	4.75	14.49	.19	.15	1.17	1.51	22
20.00	5.05	1.01	.25	26.31	9.84	6.26	16.10	.17	.10	.95	1.22	23
29.00	9.20	1.84	.46	40.50	13.80	7.24	21.04	.17	.09	.75	1.01	24
82.00	15.15	3.03	.76	100.94	21.86	8.64	30.50	2.66	.80	2.39	5.85	25
75.00	19.80	3.96	.99	99.75	24.68	11.02	35.70	1.92	.69	1.98	4.59	26
124.00	31.85	6.37	1.59	163.81	36.85	18.14	54.99	1.67	.56	1.63	3.86	27
24.00	7.75	1.55	.39	33.69	9.22	5.08	14.30	1.35	.57	1.13	3.05	28
28.00	11.05	2.21	.55	41.81	9.25	5.72	14.97	.97	.35	.85	2.17	29
37.00	12.85	2.57	.64	53.06	11.40	7.56	18.96	.62	.22	.67	1.51	30
73.00	18.35	3.67	.92	95.94	32.95	13.18	46.13	2.28	1.10	1.80	5.18	31
93.00	26.80	5.36	1.34	126.50	33.13	11.77	44.90	1.64	.58	1.53	3.75	32
129.00	29.90	5.98	1.50	166.38	39.31	17.17	56.48	1.21	.41	1.31	2.93	33
17.00	4.70	.94	.24	22.88	6.45	3.35	9.80	.76	.33	1.17	2.26	34
18.00	5.05	1.01	.25	24.31	8.78	4.10	12.88	.42	.22	1.13	1.77	35
26.00	7.00	1.40	.35	34.75	10.75	5.40	16.15	.37	.17	1.01	1.55	36
20.00	5.00	1.00	.25	26.25	1.56	1.94	3.50	.80	.11	.95	1.86	37
15.00	4.40	.88	.22	20.50	1.29	.98	2.27	.37	.04	.95	1.36	38
22.00	5.25	1.05	.26	28.56	2.78	2.13	4.91	.31	.05	.86	1.22	39

Table 12.--Major farm implements: Cost of operation per implement, value December 31, and

	Kind of implement and size of farm	Farms using	Total	Number per farm	Size	Age	Farm labor for repairs and service	Annual use per implement	Operating time per acre	Original investment	Value Dec. 31 1960
		Number	Number	Number	Feet	Years	Hours	Acres	Hours	Dollars	Dollars
	Moldboard plow:										
1	Small farms	53	59.0	1.11	2.7	10.8	2.8	52	0.91	169	83
2	Medium-sized farms	62	80.0	1.27	2.9	9.6	5.4	79	.84	244	135
3	Large farms	66	92.0	1.39	3.5	7.2	4.9	137	.64	353	188
	Tandem disk:										
4	Small farms	53	57.0	1.08	7.6	8.7	2.0	138	.40	198	94
5	Medium-sized farms	63	75.0	1.19	8.1	8.9	2.8	208	.39	258	122
6	Large farms	65	90.0	1.36	9.2	6.5	3.9	318	.30	351	186
	Spiketooth harrow:										
7	Small farms	38	38.0	.72	9.3	8.3	.5	91	.38	72	39
8	Medium-sized farms	51	56.0	.89	9.6	11.3	.9	127	.35	73	42
9	Large farms	61	80.0	1.21	11.6	6.5	.5	250	.29	100	54
	Springtooth harrow:										
10	Small farms	29	29.0	.55	8.6	10.1	.7	87	.38	114	56
11	Medium-sized farms	35	35.0	.56	9.4	6.6	1.0	172	.33	147	80
12	Large farms	39	41.0	.62	10.2	7.4	1.3	232	.28	160	91
	Cultipacker:										
13	Small farms	39	39.0	.74	8.5	12.4	.9	87	.39	103	50
14	Medium-sized farms	52	54.0	.86	9.0	12.7	.8	163	.38	127	70
15	Large farms	50	53.0	.80	10.1	6.5	1.1	257	.30	170	95
	Rotary hoe:										
16	Small farms	29	28.5	.54	9.8	9.7	.9	60	.23	107	60
17	Medium-sized farms	46	45.2	.72	10.5	9.4	.8	94	.18	149	89
18	Large farms	55	56.0	.85	13.3	6.5	1.4	172	.14	233	131
	Corn planter:										
19	Small farms	50	50.0	.94	8.0	11.1	3.4	46	.57	192	103
20	Medium-sized farms	57	56.0	.89	9.8	10.6	4.3	84	.42	271	143
21	Large farms	63	63.0	.95	13.3	5.4	5.8	164	.29	486	319
	Row cultivator:										
22	Small farms	52	54.0	1.02	8.1	10.8	4.4	99	.54	180	81
23	Medium-sized farms	61	70.0	1.11	8.8	11.2	5.8	155	.47	202	101
24	Large farms	65	83.0	1.26	11.9	8.2	6.7	243	.35	311	184
	Cornpicker:										
25	Small farms	37	36.0	2/ .68	4.2	9.4	8.0	38	1.10	742	303
26	Medium-sized farms	53	53.0	2/ .84	5.2	9.3	10.2	52	.98	844	396
27	Large farms	55	53.0	3/ .80	6.3	7.7	16.8	98	.76	1,219	637
	Grain drill:										
28	Small farms	49	49.0	.92	6.8	11.7	4.7	25	.52	330	155
29	Medium-sized farms	59	59.0	.94	7.5	11.3	5.3	43	.42	390	221
30	Large farms	63	64.5	.98	8.3	9.4	7.0	85	.31	482	257
	Combine with power takeoff:										
31	Small farms	41	40.0	4/ .75	5.9	9.4	12.2	42	.83	793	367
32	Medium-sized farms	50	49.5	5/ .79	6.0	9.6	10.9	77	.76	1,050	536
33	Large farms	45	46.5	6/ .70	6.5	6.8	15.9	137	.61	1,215	598
	Mower:										
34	Small farms	38	38.0	.72	6.5	10.7	3.1	30	.54	187	94
35	Medium-sized farms	55	55.0	.87	6.8	10.4	3.8	58	.56	231	101
36	Large farms	56	56.0	.85	6.9	8.4	5.0	93	.47	283	140
	Side-delivery rake:										
37	Small farms	28	27.5	.52	9.2	10.1	1.8	33	.44	198	100
38	Medium-sized farms	47	46.5	.74	8.6	12.8	.9	56	.47	160	88
39	Large farms	51	51.0	.77	8.3	10.7	2.0	92	.40	256	105

1/ Specified percentage of Dec. 31 value.
2/ In addition, 0.2 corn picking unit for combine.
3/ In addition, 0.9 corn picking unit for combine.
4/ In addition, 0.13 combine with auxiliary engines.
5/ In addition, 0.10 combine with auxiliary engine, and 0.06 self-propelled combine.
6/ In addition, 0.03 combine with auxiliary engine, and 0.30 self-propelled combine.

Table 13.--Major farm implements: Cost per acre of use on large and medium-sized survey farms, as percentage of cost on small farms, northwestern Ohio, 1960 1/

Item	Small farms	Medium-sized farms	Large farms
	Percent	Percent	Percent
Implements only	100	73	63
Fixed costs	100	77	66
Variable costs	100	64	59
Tractor and driver	100	83	69
Tractor	100	77	69
Driver	100	89	70
Total cost of operation	100	79	66

1/ These indexes are computed as arithmetic means of percentages with averages of items on small farms equal to 100. The first step was to express the cost for each of the 13 implements on the medium-sized and large farms as a percent of the cost on the small farms, and next, to average these relatives giving each implement equal weight.

To a greater degree than fixed costs, variable costs per acre decreased as size of farm increased. The relatively greater difference may be due to the minimum repairs required by the newer machines.

The total cost per acre of use for the 13 major farm implements, including associated tractor and driver costs, averaged about 35 percent lower on the large farms than on the small farms, and about 20 percent lower on the medium-sized farms (table 13). The cost of using such implements as spiketooth harrows is small compared with the associated cost of tractors and drivers, whereas cost of using combines and cornpickers is high relative to tractor and operator cost.

The lower total cost per acre on the larger farms was chiefly due to the larger acreage over which fixed costs were spread, and to the smaller amount of operator and tractor time needed per acre with the large tractors on these farms. The time required to cover an acre on the large farms, with an average 272 acres of cropland, averaged 30 percent less than on the small farms with 77 acres of cropland. The medium-sized farms, with 141 acres of cropland, averaged 11 percent less time per acre.

One of the major economies resulting from the higher field capacity of machines on large farms was the lower labor charge per acre for operator labor. If operator time was more fully employed on these farms than on smaller farms, and therefore more valuable, the extra field capacity resulted in a greater difference between large and small farms in cost per acre of operation than is indicated in this analysis.

COST OF OPERATION OF MACHINERY PER FARM AND PER ACRE OF CROPLAND

The preceding analysis shows the relation of size of farm to cost of tractors and implements per unit of use. At least two other aspects of machinery costs are of interest to farmers. These are the machinery costs for the farm as a whole, and total machinery costs per acre of cropland in the farm.

Original Investment and Value as of December 31, 1960

The average value as of December 31, 1960, of tractors and the 13 major types of implements was more than twice as great on the large survey farms as on the small farms, as was the original investment per farm (table 14). The differences for other equipment were even greater. Because machinery was kept longer on the small farms, total depreciation was proportionately larger despite the purchase of more used equipment. On the small farms, value as of December 31, 1960, of tractors and all farm equipment except trucks and automobiles averaged 45 percent of the original cost, compared with 53 percent on the medium-sized farms and 57 percent on the large farms.

Large farms had a considerable advantage in lower original investment per acre of cropland. Original investment in all machinery excluding trucks and autos was $53 an acre on the large farms compared with $62 an acre on the medium farms and $77 an acre on the small farms.

Table 14.--All farm machinery: Original investment and current value per farm and per acre of cropland, small, medium-sized, and large survey farms, northwestern Ohio, 1960[1/]

Item	Small farms	Medium-sized farms	Large farms
	Dollars	Dollars	Dollars
Original investment--			
Per farm:			
Tractor	2,320	3,184	5,088
13 major implements	2,657	3,670	5,111
Other implements and equipment	945	1,915	4,222
Total	5,922	8,769	14,421
Per acre of cropland:			
Tractors	30.13	22.58	18.71
13 major implements	34.51	26.03	18.79
Other implements and equipment	12.27	13.58	15.52
Total	76.91	62.19	53.02
Value December 31, 1960--			
Per farm:			
Tractor	965	1,679	2,888
13 major implements	1,246	1,906	2,738
Other implements and equipment	472	1,082	2,550
Total	2,683	4,667	8,176
Per acre of cropland:			
Tractors	12.53	11.91	10.62
13 major implements	16.18	13.52	10.07
Other implements and equipment	6.13	7.67	9.38
Total	34.84	33.10	30.07

[1/] Does not include trucks and automobiles.

Investment per acre in tractors and in the 13 major kinds of implements went down as farm size increased, but the large farms had the highest per-acre investment in other equipment. Four kinds of equipment--self-propelled combines, balers, elevators, and wagons--accounted for nearly 70 percent of such investment on the large farms.

Cost Per Acre of Cropland of Operating Tractors and Major Farm Implements

With operator labor valued at $1.08 an hour, the cost per acre of using tractors was about the same as the charge for the operator. Cost of tractor and operator per acre of cropland was about 90 percent as high on medium-sized as on small farms, and about two-thirds as high on large farms (table 15).

On each size of farm, the cost of using the 13 major kinds of implements averaged a little more than half the associated cost of tractors and operators (table 16). Thus, as would be expected, the relationship between size of farm and costs of implement, tractor, and operator was about the same as that between size of farm and costs of tractor and operator only.

Table 15.--Tractors: Cost per farm and per acre of all operations on small, medium-sized, and large survey farms, northwestern Ohio, 1960

Item	Small farms	Medium-sized farms	Large farms
	Dollars	Dollars	Dollars
Cost per farm for:			
Tractor	547	836	1,294
Operator	542	960	1,306
Total	1,089	1,796	2,600
Cost per acre of cropland for:			
Tractor	7.10	5.93	4.76
Operator	7.04	6.81	4.80
Total	14.14	12.74	9.56

Table 16.--Major farm implements: Cost per farm and per acre of cropland for all operations including associated tractor and operator costs; small, medium-sized, and large survey farms, northwestern Ohio, 1960

Item	Small farms	Medium-sized farms	Large farms
	Dollars	Dollars	Dollars
Cost per farm for:			
Implement	357	611	907
Tractor and operator 1/	661	978	1,471
Total	1,018	1,589	2,378
Cost per acre of cropland for:			
Implement	4.64	4.34	3.33
Tractor and operator 1/	8.58	6.94	5.41
Total	13.22	11.28	8.74

1/ Cost associated with these implements only.

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APPENDIX

Table 17.--Number of farms using specified combinations of tillage equipment; small, medium-sized, and large survey farms, northwestern Ohio, 1960

Item	Small farms	Medium-sized farms	Large farms
Number of farms in sample	53	63	66
Combination:			
Two tandem disks	1	0	1
Two tandem disks and cultipacker	0	0	1
Tandem disk and spiketooth harrow	24	19	33
Tandem disk and springtooth harrow	6	5	6
Tandem disk and cultipacker	17	22	11
Tandem disk and drill	3	6	8
Tandem disk and cultimulcher	1	0	2
Tandem disk and rotary mower (chopper)	1	1	0
Tandem disk, spiketooth harrow, and cultipacker	5	12	13
Tandem disk, springtooth harrow, and cultipacker	9	9	8
Tandem disk, springtooth harrow, and spiketooth harrow	0	1	1
Tandem disk, spiketooth harrow, and cultimulcher	0	1	1
Tandem disk, drill, and cultipacker	0	0	1
Spiketooth harrow and cultipacker	2	1	6
Springtooth harrow and cultipacker	3	4	10
Springtooth harrow and spiketooth harrow	3	2	6
Spiketooth harrow, springtooth harrow, and cultipacker	0	4	3
Drill and cultipacker	0	0	1
Drill and spiketooth harrow	0	0	2
Lime spreader and drill	0	0	1
Lime spreader and seeder	0	0	2
Cultipacker and seeder	0	0	1
Field cultivator, tandem disk, and spiketooth harrow	0	0	1
Cultimulcher and spiketooth harrow	0	0	1
Cultimulcher and drill	0	0	1
Cultimulcher and cultipacker	0	1	0
Springtooth harrow and weeder	0	1	0
Sprayer and planter	0	1	0
Soil surgeon and cultipacker	1	0	0
Row cultivator and weeder	1	0	0

Table 18.--Major farm implements: Acreage covered in 10-hour day with implement of specified width, and per 1-foot width of implement; small, medium-sized, and large survey farms, northwestern Ohio, 1960 1/

Kind of implement	Small farms			Medium-sized farms			Large farms		
	Width of implement	Acreage per day		Width of implement	Acreage per day		Width of implement	Acreage per day	
		Total	Per foot of width		Total	Per foot of width		Total	Per foot of width
	Feet	Acres	Acres	Feet	Acres	Acres	Feet	Acres	Acres
Moldboard plow	2.7	11.0	4.1	2.9	11.9	4.1	3.5	15.7	4.5
Tandem disk	7.6	25.0	3.3	8.1	25.7	3.2	9.2	33.3	3.6
Spiketooth harrow	9.3	26.4	2.8	9.6	28.7	3.0	11.6	34.5	3.0
Springtooth harrow	8.6	26.6	3.1	9.4	30.6	3.3	10.2	35.1	3.4
Cultipacker	8.5	25.6	3.0	9.0	26.5	2.9	10.1	33.6	3.3
Rotary hoe	9.8	43.3	4.4	10.5	55.4	5.3	13.3	71.5	5.4
Corn planter	8.0	17.4	2.2	9.8	24.1	2.5	13.3	34.2	2.6
Row cultivator	8.1	18.4	2.3	8.8	21.2	2.4	11.9	28.6	2.4
Cornpicker	4.2	9.1	2.2	5.2	10.2	2.0	6.3	13.2	2.1
Grain drill	6.8	19.4	2.9	7.5	23.7	3.2	8.3	32.0	3.9
Combine with power takeoff	5.9	12.1	2.1	6.0	13.1	2.2	6.5	16.4	2.5
Mower	6.5	18.5	2.8	6.8	17.9	2.6	6.9	21.4	3.1
Side-delivery rake	9.2	22.7	2.5	8.6	21.5	2.5	8.3	24.7	3.0

1/ See table 12 for basic data.

Table 19.--Tractors, wheel-type: Fuel used per 10-hour day, by kind of fuel, size of tractor and kind of work, survey farms, northwestern Ohio, 1960

Rated drawbar horsepower	Heavy drawbar			Light drawbar			Stationary		
	Tractors	Range	Average	Tractors	Range	Average	Tractors	Range	Average
	Number	Gallons	Gallons	Number	Gallons	Gallons	Number	Gallons	Gallons
GASOLINE									
Under 13.0 ---	6	12-25	17.8	15	5-17	10.0	5	7-15	10.8
13.0 to 14.9--	13	10-30	20.6	29	5-20	11.2	6	7-20	14.2
15.0 to 18.9--	33	15-40	22.8	45	7-20	12.6	12	10-24	18.3
19.0 to 20.9--	45	12-40	23.1	52	7-20	13.5	13	8-25	16.6
21.0 to 23.9--	46	15-36	24.0	50	9-20	13.0	16	8-25	18.9
24.0 to 26.9--	55	15-35	26.3	48	8-30	15.6	17	11-30	24.8
27.0 to 31.9--	42	20-40	28.7	35	8-25	15.6	10	10-30	22.5
32.0 to 35.9--	35	24-35	30.2	31	12-25	17.3	12	12-30	23.8
36.0 to 38.4--	16	25-40	33.3	15	15-25	20.1	7	12-40	28.7
DIESEL FUEL									
26.0 to 31.0--	9	15-30	21.9	8	5-20	10.9	2	15-20	17.5
33.0 to 38.0--	11	15-35	26.4	9	10-20	15.0	1	---	10.0
40.0 to 44.0--	3	25-30	28.0	2	14-15	14.5	1	---	20.0
TRACTOR FUEL									
Under 13.0----	---	---	---	1	---	8.0	---	---	---
13.0 to 18.9--	6	17-35	24.0	3	7-20	12.3	4	10-35	19.75
19.0 to 24.0--	5	17-25	20.8	2	10-12	11.0	4	15-25	19.25

Table 20.--Tractors, wheel-type: Oil and grease used per 10-hour day, by size of tractor, survey farms, northwestern Ohio, 1960 1/

Rated drawbar horsepower	Oil			Grease		
	Tractors	Range	Average	Tractors	Range	Average
	Number	Quarts	Quarts	Number	Pounds	Pounds
Under 13.0 -------	13	0.46-1.33	0.86	15	0.06-.25	0.13
13.0 to 14.9 -----	26	.27-1.40	.72	31	.03-.20	.09
15.0 to 18.9 -----	48	.33-1.75	.78	49	.06-.50	.13
19.0 to 20.9 -----	53	.35-2.67	.97	55	.06-.25	.14
21.0 to 23.9 -----	51	.45-2.62	.84	53	.06-.50	.15
24.0 to 26.9 -----	56	.42-2.33	.98	57	.03-.37	.16
27.0 to 31.9 -----	44	.25-2.13	.87	45	.06-.25	.13
32.0 to 35.9 -----	35	.45-1.33	.77	35	.06-.31	.17
36.0 to 43.4 -----	16	.30-1.10	.81	16	.12-.25	.17

1/ Based on gasoline tractors only. Data in this table were also used for tractors using diesel or tractor fuel.

Table 21.--Tractors, wheel-type: Antifreeze used during year, by size of tractor, survey farms, northwestern Ohio, 1960 1/

Rated drawbar horsepower	Total tractors	Use of antifreeze				
		Tractors	Range	Average	Percentage of total tractors	Average all tractors
	Number	Number	Gallons	Gallons	Percent	Gallons
Under 13.0------	15	11	1.0-2.5	1.24	73.3	0.91
13.0 to 14.9----	31	26	1.0-3.0	1.33	83.8	1.11
15.0 to 18.9----	49	42	1.0-3.0	1.50	85.7	1.29
19.0 to 20.9----	55	50	1.0-3.0	1.92	90.9	1.74
21.0 to 23.9----	53	51	1.0-3.0	1.70	96.2	1.64
24.0 to 26.9----	57	56	1.0-5.0	2.09	98.2	2.05
27.0 to 31.9----	45	42	1.0-3.0	1.90	93.3	1.78
32.0 to 35.9----	35	35	1.0-3.0	2.12	100.0	2.12
36.0 to 43.4----	16	16	.75-3.0	1.98	100.0	1.98

1/ Based on gasoline tractors only. Data in this table were also used for tractors using diesel or tractor fuel.

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